

GCE 2004

June Series



Mark Scheme

Chemistry

(Subject Code CHM3/P)

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Dr Michael Cresswell Director General

CHM3/P Practical Examination**Exercise 1**Skill assessed **Implementing (2)**

Reactions of some ions.

(a) Points assessed by supervisor during the practical examination.

- | | | |
|-------------------------|---------------------------------------|------------------|
| (i) test tube reactions | 1 uses appropriate quantities | |
| | 2 dropwise addition where appropriate | |
| | 3 no spillages | |
| | 4 shakes mixture | 6 scoring points |
| | | all 6 = 2 marks |
| | | any 4 = 1 mark |
| (ii) general | 5 does not require additional sample | |
| (iii) safety | 6 works safely - eye protection etc | |

(b) Points assessed from candidate's written report.

- | | | |
|------------------------------|---|--------|
| (i) the recording of results | results recorded clearly and in full in the table | 1 mark |
| Notes | <i>* If you can read it, it is clear</i> | |
| | <i>* Full means completes at least 13 boxes</i> | |

(ii) The accuracy of the observations. 15 scoring points

14 – 15 points	5 marks
11 – 13 points	4 marks
7 – 10 points	3 marks
4 – 6 points	2 marks
1 – 3 points	1 mark

- Notes
- * Check the teacher observations against the published grid, noting any significant discrepancies;
Na₂CO₃ and HCl likely to be 'No visible change'
 - * Keep these discrepancies in mind when marking the scripts; allow either the published answer or the teacher alternative
 - * If answers contradict e.g. "No visible change with white precipitate" then scoring point is not awarded
 - * Look for the basic colour; ignore additional shades if the answer is unambiguous; clear is not the same as white/colourless
 - * If centre puts 'red/brown' allow 'red' or 'brown'
 - * Accept suspension, sediment, solid deposit as well as precipitate for 'white precipitate' accept 'milky precipitate' but not 'milky' on its own
no change, no reaction, stays the same as well as no visible change
 - * If "cloudy" or "misty" or "emulsion" used throughout instead of precipitate, mark the colours for these boxes, total the points scored, convert to a mark out of 5, then deduct 2 marks
 - * If 'precipitate' used at least once, penalise all answers which expect a precipitate in the answer but the word itself is omitted

Total 8 marks

	Na₂CrO₄	BaCl₂	Pb(NO₃)₂	KI	Na₂CO₃
Test	Observations with Solution A	Observations with Solution B	Observations with Solution C	Observations with Solution D	Observations with Solution E
1. Reaction with silver nitrate solution	red precipitate (1) or red/brown precipitate	white precipitate (1)	no visible change (1)	yellow precipitate (1)	white precipitate (1) or brown precipitate
2. Reaction with hydrochloric acid	(yellow solution gives) orange solution (1)	no visible change (1)	white precipitate (1)	no visible change (1)	effervescence or bubbles of gas (1) not fizzes
3. Reaction with magnesium sulphate solution	no visible change (1)	white precipitate (1)	white precipitate (1)	no visible change (1)	white precipitate (1)

Exercise 2Skill assessed **Analysing (3)**

Determination of the number of molecules of water of crystallisation in hydrated calcium sulphate crystals.

- | | | | |
|---|--|---|------------------|
| 1 | Draws best fit straight line | | 1 mark |
| | Notes | * <i>Line must not deviate towards reading at 0.25g</i>
* <i>Line must go through the origin - complete extrapolation if not done by candidate</i> | |
| 2 | Uses the graph to determine the mass to form 1.000g | 1.29g | 1 mark |
| | Notes | * <i>Allow 1.28 - 1.30</i>
* <i>Allow consequential answer if line drawn is not best fit</i> | |
| 3 | Calculate the number of moles in 1.000g of CaSO ₄ | 7.34 x 10 ⁻³ | 1 mark |
| | Notes | * <i>Mr of CaSO₄ is 136.2</i>
* <i>Using 136 gives 7.35 x 10⁻³; allow here but loses precision mark</i>
* <i>Allow consequential answer from part 2</i> | |
| 4 | Calculate the M _r of CaSO ₄ .xH ₂ O | 175.7 | 1 mark |
| | Notes | * <i>Must use answers from parts 2 and 3 to earn this mark</i>
* <i>Allow consequential answer from part 3</i>
* <i>1.28g gives 174.3; 1.30g gives 177.1;</i> | |
| 5 | Calculate the degree of hydration, x | 2.19 (2) | 1 mark |
| | Notes | * <i>174.3 gives 2.12; 177.1 gives 2.27;</i>
* <i>Allow consequential answer from part 4</i> | |
| 6 | Calculates the percentage error in using the balance | 0.4% | 1 mark |
| | Notes | * <i>Ignore precision of answer</i> | |
| 7 | Precision | 2 mass to 2 or 3 sig figs
4 M _r to 1 dec place
5 value of x to 3 sig figs or integer | any 2 for 1 mark |
| | Notes | <i>If candidate uses M_r 136 in part 3 loses precision mark</i> | |
| 8 | Nomenclature | clear sharp line on graph
calculations clear & logical, with sensible layout
units where used are correct | all 3 for 1 mark |

- Notes * *Incorrect units mean the nomenclature mark is lost*
* *Two blank sections mean the nomenclature mark is lost*
* *Don't penalise missing units*
* *Answer given part 2, 3, 4 or 6 without working means the nomenclature mark is lost*

Total 8 marks

Skill assessed **Evaluating (4)**

- 1 (a) yes / good straight line / can use with confidence 1 mark
(b) anomalous result at 0.15/0.25 g 1 mark
Notes * *Must make a clear written comment for first point*
* *Second point in answer here or clearly from the graph*
* *Deviation of line of graph loses second mark*
- 2 ensure reaction complete/ ensure all water lost 1 mark
- 3 calculations difference $175.7 - 172.2 = 3.5$ both = 1 mark
percentage $(3.5 * 100) / 172.2 = 2.0\%$
Notes * *Ignore precision of answer*
* *Consequential marking from Q3 of Analysis*
* *Difference must be clearly stated*
* *Lose mark if the candidate answers a different question*
* *Alternative values 165.2 difference is 7.0 and % is 4.1*
174.3 difference is 2.1 and % is 1.2
177.1 difference is 4.9 and % is 2.8
- 4 (a) % errors in weighing/mass are too large with 0.100g 1 mark
or hard to weigh accurately
(b) may not decompose fully 1 mark

Total 6 marks

Exercise 3Skill assessed **Planning (1)**

Confirming the equation of an acid - metal reaction.

The mark scheme is in five sections

- (a) the scale of working used **s** max 3 scoring points
states appropriate volume of gas to be collected - *allow 25 - 250 cm³*
calculates moles of hydrogen for stated volume
calculates mass of strontium needed (0.37g Sr gives 100 cm³ of H₂)
Notes * *To score last two points need a definite correct link between mass and volume*
- (b) the apparatus used **a** max 4 scoring points
balance - *allow without precision specified, or from a list*
appropriate container for reaction - *allow test tube or flask but not beaker*
describes method of collection of gas - over water or in a syringe - *to show they know how*
measuring cylinder or pipette for acid - *allow without precision specified*
Notes * *Can score points from a diagram*
- (c) the method used **m** max 5 scoring points
weighs strontium
adds excess acid
precaution to avoid gas loss on mixing *not addition from burette or tap funnel*
allows reaction goes to completion
measures volume of hydrogen produced
repeats experiment
measures room temperature and/or pressure
Notes * *Ignore additional apparatus unless contradictory - lose apparatus point(s)*
* *If method is clearly unworkable, CE; allow 'weighs strontium' and 'repeats experiment' otherwise allow no other scoring points for the method section; for awkward cases consult DGW*
- (d) the use of results **r** max 4 scoring points
correct calculation of moles of strontium
uses gas equation or 24 dm³ - *can score from scale section*
correct calculation of moles of hydrogen produced
confirms 1:1 ratio of strontium : hydrogen
Notes * *Last point is only awarded if the rest of the calculation is sensible; do not award as an isolated statement*

- (e) the appreciation of likely hazards and safety precautions **h** max 2 scoring points

hydrogen/strontium flammable

avoid naked flames or fume cupboard

hydrochloric acid corrosive/irritant

gloves/wash spillages

eye protection

Notes * *Need hazard and precaution for points 1 and 2*

GRADING

18 scoring points	17 – 18 scores	8 marks	9 – 10 scores	4 marks
	15 – 16 scores	7 marks	6 – 8 scores	3 marks
	13 – 14 scores	6 marks	3 – 5 scores	2 marks
	11 – 12 scores	5 marks	1 – 2 scores	1 mark